First signs of life: The Inception of a Living Lab

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Abstract A Living Lab is supposed to offer an environment where users and producers co-create innovations. So what happens when it is placed in a school class? Does chaos ensue? This paper presents the story of the opening phase of a Living Lab. Fundamentally, user-driven innovation is the aim of the Living Lab and successful co-design is an important element. The purpose of the innovation is to design new ways of reducing energy use by involving building users. School children are at the heart of this process. The challenges and processes of working with school children are discussed, and the difficulties faced in the co-design phase are explored. The maturity and skills of the children and social dynamics of the group affect the co-design process. A key consideration for the facilitators is the characteristics of the participants, and how to work with them most effectively.

Keywords: Schools, Energy, Design, Pedagogy

INTRODUCTION

Learning from people as they use a building seems to be the most effective way of understanding how energy is used. Janda, (2011) argues that building users play a critical but poorly understood role in energy use in buildings and cites Orr (1997) for his belief that buildings can embed a curriculum as well as the classes that are taught there. Energy illiteracy and apathy have been linked to a general disregard for how energy is used in buildings (Newborough & Probert, 1994) and there is a growing sense that school aged children are the key to societal change in attitudes to energy consumption (Dias, Mattos, & Balestieri, 2004).

This paper reports on the 'opening' phase of a Living Lab set up in two school buildings. This move is part of a larger project that is examining ways to reduce energy use by involving building user communities. The school buildings provide useful context for taking the Living Labs forward. The shared occupancy of the school over a number of years appears to give children a sense of ownership, and also a common responsibility for their space. The pedagogical effect of a building on educational progress is recognised by many authors (Flutter, 2006; Woolner, Hall, Higgins, McCaughey, & Wall, 2007), but the effect of the building on occupant energy use is far less understood. The Living Lab model offers potential for discovering ways for people to use energy in buildings more effectively. By working with community members that seldom have direct influence or responsibility for energy management, it is believed that new modes of understanding will emerge.

SETTING UP LIVING LABS IN SCHOOLS

The Living Lab became our vehicle for learning how school children see energy within their school buildings. The idea of the Living Lab allowed the conceptualisation of a process of discovery: to find out what energy use looks like from the perspective of a school child within the wider organisational 'system' that is a school. This paper presents the unfolding process that led to the inception of our Living Lab.

Our living lab is to be based around a set of designed prototypes that would be deployed within the schools for the school students to live with and use. However, the motivation for using a Living Lab based approach was formulated in recognition that the schools are extremely specific, and yet internally diverse communities. Our prototypes, if they are to form the basis of a successful Living Lab, need to be designed to properly address the needs and values at play within our chosen communities.

In order to begin the design process then, and to gain the necessary more thorough understanding of the contexts or our Living Lab, we conceived a series of design workshops that would allow us to work with school children in exploring the energy systems of their schools, and to look at designing new kinds of energy systems.

The intention of these workshops was not one of co-design of specific devices from the living labs as such, but more ways of allowing both the children's and ourselves to explore and become more familiar with their values around energy, as well as the social elements of school life, so that we can begin to design these prototypes.

The Schools

Two schools are participating in the Living Lab, both in central Scotland. The Schools are very different sites in terms of requirements and management of energy. One was built (School A) in the 1960's, and has had various energy systems retro fitted to the original over the last 25 years. It is on the whole an inefficient building in terms of maintaining thermal comfort and as such uses a lot of electricity. The other school (School B) is a relatively new building, constructed in the last 5-10 years, with a Building Management System integrated from the outset. As a building it is much more efficient, but still uses more energy than predicted throughout the areas where people use things that consume electricity.

These differences mean that the users of the respective building have very different relationships to energy and comfort within the buildings. As a result, our scoping workshops were structured in a way that would allow this individuality to come out. The workshops were carried out with children in their third year of secondary education (13-14years). The timetabled classes replaced by the workshops were Maths; Geography; and Science.

Curricular Framing

The Living Lab occurs during the school day, and needs to respond to the curriculum framework in order to gain acceptance amongst teachers and the wider school community. The new Curriculum for Excellence (CfE) has been introduced in Scotland to encourage cross-curricular learning, and opportunities that combine different topic areas are central to this (Education Scotland 2014). The curriculum has a central ambition of enabling young people to become confident individuals and responsible citizens, as well as successful learners.

The Living Lab aims to offer an opportunity to learn about and participate in the development of an energy system within the school community. This offers potential to develop knowledge across a wide spectrum of school subjects. The Living Lab's central theme of energy, maps onto broad areas of the curriculum including numeracy; social studies; science; expressive arts; technologies; and moral education.

Initial activity has taken place in geography, maths, physics and general science classes. However, the workshops are classified as project activity and therefore do not need to meet particular curriculum requirements. Instead the Living Lab becomes a place where learning is applied to a real world problem using the skills and knowledge from across

DESIGN NARRATIVES: THE WORKSHOPS

The workshops took place during three one hour lessons, over the course of one week. Based around Ideation Decks (Golembewski & Selby, 2010), a card based ideation method for engaging in a design process.

Session 1: Data Collection

The first workshop was based around data collection, by identifying things in the school that used energy. After a short introduction to the project, the school students were split into groups of 4-5, and given a specific area of the school to explore.

Lists - They were then given pre-printed sheets on which to list the things they found there, categorising them into People, Object, Data and Machines. They then went to their designated zones where they listed everything they saw that they thought used energy, or might be related to energy use.

IPads - The groups from School A are provided with iPads by the school, so they were also able to make short videos to document their zones. The students from School B, were able to use iPads provided during the workshop, so that they could also make videos and take photos (fig 1).

Figure 1: Children's view of energy in the schools

Making Cards - The items on the lists were then used to populate a set of pre printed cards. The students selected an item from their list, and taking a new card of the same category as that list item, they drew a representation of that list item on the card. These cards would be used in the next session to generate narrative and idea about energy use (fig 2).

Figure 2: Energy lists and cards for People, Object, Data and Machines

Session 2: Data, Narratives and Stories

Graphs - On the second day, the students were given graphs that showed electricity use for a full day in their school. The granularity of data available differed between schools. In School A, the graphs showed 24 hours of electricity use for the whole school, while students at School B given a graph that showed 24 hours of electricity use for different zones in the school. Where possible, these were matched to the zone that they had visited in the previous session, although this was not always possible. This perhaps points to a mismatch between mental models of the school building, and that of the energy systems

Card Exercise - The students selected a point on the graph, representing an amount of every being used at a particular time of day. They then selected three or four cards, each from a different category. Looking at the time of day they had chosen, they were to use the items shown on their chosen cards to come up with a narrative, story about how that energy might have been used.

Session 3: Design Fictions

The last session explored an energy fiction that involved the objects, machines, data and people. Groups were asked to address one of the narratives explored in the previous session, and design a solution to reduce energy consumption. The process was free to become as bizarre and fanciful as desired, but with the ultimate aim of reducing energy use where it was not required. The outcomes of this process were varied and represented some very detailed and pragmatic responses and some wildly creative ideas. The intention of this process was to allow the children to explore possible (and impossible) modes of working differently with their school building. Many of the concepts were based around the idea of small but very frequently repeated actions, i.e. walking up a stair.

Interactions between school children and IT were also a common theme, with the notion of sensors and actuators (not always expressed semantically) present in many designs.

CHALLENGES

Throughout the design workshops we faced several challenges from the social and pedagogic elements of the school environment. The primary challenges were oriented around the diversity of the community both in terms of social groups and academic engagement.

Social

Within each class there were many different social groups with deeply ingrained dynamics that were difficult to negotiate, and were at times disruptive to the progress of the workshop activities. Students worked in groups, which tended to be with their friends in the class, and pre-established patterns of behaviour continued. For example, there were frequent discussions about whose turn it was to do the writing, or drawing, where one member of the group ended up being responsible for recording their ideas. This meant that engagement with subject and in the design process was somewhat stunted in some working groups.

Working with teachers was of course vital in this respect as they were of course familiar with the social dynamics at play within the groups, and able to mitigate or encourage them where necessary. These factors may be expected when working in such an environment, but our scoping workshops allowed us to see them at play, and in context. As such these challenges can be taken into account when planning the next phase of our Living Labs. Indeed, while they proved challenging in some respects the social dynamics within the school, and the classes we worked with have also provided interesting design inspiration for the systems we may develop to support the living labs. In this case, working with teachers to circumvent disruptive social dynamics entirely may have been less rewarding in the long run, due to the exploratory nature of the workshops.

Educational

Another challenge was that the format of the workshop was sometimes at odds with the pedagogic expectations of the classes. Although there is now a curricular emphasis on multidisciplinary learning (more on which later), the exploratory and creative, nature of the activities went against the expectations of a group of pupils going into their science, or maths lessons, for example. While we were interested in what the pupils thought, they expected to be taught. This discrepancy between expectation and the task sometimes meant that pupils were unsure of what we wanted them to do, and whether they were doing what we wanted them to do, which in turn prevented them from engaging fully with the activities. As such we often struggled to encourage them to think freely, and assure them that there was no ‘correct answer’. Any further activity will have to emphasise playfulness and investigation through the design of prototypes that form the basis of our Living Labs.

Going into these workshops we also had to make assumptions about the pupils’ existing knowledge. We had brief discussions with teachers about what they had been learning in class, and so were able to relate our activities to things they knew about. However the key area where we misjudged their knowledge was in the terminology. For instance the categories, People Objects Data and Machines were terms that we found useful in defining the research project, but often proved difficult for the students We decided to use these terms in the school workshops as they were somewhat ambiguous, and we wanted to see how the students understood and interpreted them, so that we

might see how they understood different elements of the energy system. This prompted interesting discussions about what, for example, differentiated machines and objects. However terms like 'data' were for the majority a little too opaque, and very few groups were able to agree what data might be.

The extent of these challenges varied between groups, but in all cases it was again extremely important to work with the teachers of those classes. These teachers were present during all workshop sessions, and so were able to help direct pupils' attentions, and to some extent explain the activities such that the classes were better able to understand them in relation to things they may have previously studied in class.

Design / creative process

The workshops were intended to guide the pupils through a brief design process wherein they familiarised themselves with the context, identified problems and opportunities, and then designed systems to address them.

Related to the above issues about pedagogic expectations, however, managing the open-endedness of this task proved extremely difficult in some cases. It was difficult for many pupils to understand what they had to do, how it related to the previous activity, and why it was necessary to the next. This, combined with no pre-determined outcome meant that some groups, but by no means all, were not motivate to engage in the task this could in part be addressed by clearer description of the workshop process at the beginning.

We made attempts to manage this, but an effective balance between direction and openness was difficult to achieve. Having gone through the process ourselves when preparing for the workshops, we were able to show examples. On one hand this helped the pupils to understand what we were asking of them, however at the same time these examples were quite leading, meaning that many groups ended up with similar design ideas that resembled to greater and lesser extents, the example shown. To mitigate against this we emphasised quantity, and encouraged groups to come up with as many ideas as they could, and not to worry about thinking them through in too much detail. While this definitely led to some extremely diverse, imaginative and playful outcomes, it also showed that the creative process is extremely challenging, and that we perhaps misjudged the time it takes to go through this process, especially when it may be unfamiliar.

CONCLUSIONS

The Living Lab placed into active schools offer particular challenges due to the characteristics of both building, and their user communities. They will grow and evolve as interaction with the school children (and in the future the teachers, and building managers) and the energy system dictates the direction that the Living Lab takes. The process of 'ideation' was useful in uncovering energy use from the perspective of the children and recognising fundamental differences to the views of energy use held by building managers. Currently there appears to be a dis-connect between the user community and the physical infrastructure of the school buildings. There is a dominant view that energy is used by objects within the school, rather than the building itself. The reason for this emphasis needs to be explored to understand if this is because of a lack of awareness or responsibility for energy management. Interesting narratives of energy misuse emerged and lifts;

microwaves; ventilation systems; electronic scoreboards all feature. Learning from the building users and seeing energy from their perspective, seems to offer some potentially interesting ways of addressing energy use.

It is clear that children bring their own experience and knowledge to bear, and it is particularly important to include their perspective in any design for a user-driven energy system. As a participant in the daily life of the school they 'see' how energy is used and mis-used in the building constantly. The Living Labs offer a place to capture this knowledge and include this group of building users, largest in number, but least influential in the traditional hierarchy of a building energy management system. The co-design process in this context presents real challenges to the designers facilitating the workshops. The risk of providing ready-made solutions is wrapped up with the pedagogic practice of offering examples. In these Living Labs, this seemed to lead to these examples becoming a dominant theme in many of the emerging ideas. Facilitating this process then becomes a balance between inspiring and encouraging idea formation.

The Living Lab is something that has been conceptually placed into a school to address a real world problem that exists in most schools: the need to reduce energy use, coupled with a diverse and large user community. The Living Labs provide a foundation for co-designing prototypes for energy efficiency and the next phase of the project will begin to co-design solutions that are targeted at specific problems within the school building. Taking this forward ensuring the children's view is maintained is going to be a challenge for the designers as we move to embed this in the traditional working of a building management system and organisation.

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